Summary of results from pre-2001 perennial flow transition studies

Introduction

Prior to the 2001 CMER pilot study, several TFW cooperators conducted independent field studies of the distribution of perennial and seasonal headwater streams (Table 1). All of the studies were conducted during the summer low flow seasons of 1998 or 2000, in part, to evaluate proposed regulatory guidelines that differentiate non-fish-bearing headwater streams on the basis of the seasonal flow regime (i.e. perennial vs. seasonal). However, each study was designed more-or-less independently and utilized slightly different field methods.

Table 1. Summary of available Washington perennial stream studies from 1998 and 2000.

Study sponsor	Contact person	Study area (location)	Year visited	Total sites (#)	Regulatory default region	Average annual precip. (inches)
Champion Timberlands	Mike Liquori[1]	Kapowsin (W. central Cascades)	1998	86	Western WA	35-95”
Longview Fibre	Jim MacCracken[2]	SW Washington	1998	68	Western WA	48-112”
		Mid-Columbia (Col. Gorge)	1998	32	Western & Eastern WA	32-114”
		Chelan (E. Cascades)	1998	38	Eastern WA	18-60”
Wash. Dept. Fish. & Wild.	Mark Hunter[3]	Stillman Basin (Willapa Hills)	2000	10	Western WA	60-110”
Skagit System Cooperative	Curt Veldhuisen[4]	Skagit River area (NW. Cascades)	2000	43	Western WA	62-116”
Contact information (email, phone): 1 – mliquori@campbellgroup.com, (206) 817-2137 2 - jmac@longfibre.com, (360) 575-5109 3 - HUNTEMAH@dfw.wa.gov, (360) 902-2542 4 – cveldhuisen@skagitcoop.org, (360) 854-7050						

The results of these pre-2001 studies are relevant to the subsequent CMER study for two reasons. First, preliminary data from several of these studies (i.e. Kapowsin and undocumented Weyerhaeuser studies) supported the development of the default basin area acreage values established in the Forest and Fish Report (Mike Liquori, personal communication). Secondly, the field experience and findings generated from these studies provided important background information for the ongoing CMER effort.

The purpose of this appendix is to summarize available results of pre-2001 studies for the convenience of readers of the 2001 pilot report. This appendix summarizes results from the four studies that were provided to the Np Technical Group in response to email requests within the CMER community. Each of these studies is documented more thoroughly in unpublished reports cited in the Reference section of this appendix. Readers interested in additional details on the individual studies should consult the original reports and/or authors (contact information supplied at the bottom of Table 1). This appendix provides minimal interpretation or synthesis of these study results, due mainly to the differences in field methods among various component studies.

Overview of Study Methods

All pre-2001 studies were done prior to the development of standard protocols (i.e. Np Survey Working Group, 2001). In fact, during this period there was considerable uncertainty regarding what field conditions would constitute a Type Ns/Np break. Original reports should be consulted for additional details.

Study Areas and Site Selection: Four of the six study areas are within the western Washington (non-coastal) regulatory default area (Table 1). Average annual precipitation for these sites ranges from around 40 to 120 inches. Longview Fibre's Chelan study area and portions of the Columbia Gorge study are located in the eastern Cascade regulatory region and receive 24-60 inches of precipitation (Table 1). Both studies are within 50 miles of the Cascade Crest, however. None of the pre-2001 studies include areas in the eastern interior or the coastal spruce zone. Individual study areas were bounded on the basis of either land ownership (i.e. Champion and Longview Fibre studies) or watershed boundaries (i.e. WDFW and SSC studies). Site selection approaches varied between studies, and incorporated considerations including accessibility, spatial representation, randomization, and/or proximity to pre-existing study sites.

Field Survey Methods: Field data collection methods varied considerably among the pre-2001 studies, though certain generalities can be made. All field surveys occurred during the late summer/early fall dry season. Most surveyors walked along small channels until they identified a point where the channel was wet downstream and dry upstream. Because the field definitions and terms for such points differed between studies (Table 2) they are referred to generically in this report as "flow transition points". Many investigators (i.e. Longview Fibre and Skagit studies) walked an additional several hundred feet up and downstream from potential flow transition points to verify that the flow status had changed for a substantial length. Most studies characterized, to some extent, channel conditions (e.g. gradient, substrate, channel width) at flow transition points, though most reports provide minimal documentation. Studies varied considerably in their consideration of so-called "spatial intermittent" segments, in which multiple flow transition points occurred along a single stream during field surveys. Only the Kapowsin study (Liquori 2001) differentiated between flow transition points at the upstream end of spatially continuous vs. discontinuous (or "spatially intermittent") reaches. From available documentation, it is not clear how any of the pre-2001 transition points compare with the flow transition points identified using the 2001 pilot method (Np Survey Working Group 2001).

Point Location and Basin Area Determination: Field identified flow transition points were mapped onto topographic maps or aerial photographs with assistance from hand compass, hip chain and/or hypsometer (AKA "laser range-finder") information. Many of the pre-2001 sites were revisited during the 2001 UPSAG pilot project, and documented using the standard method (Np Survey Working Group 2001). Contributing basin areas for flow transition points were determined using GIS or visual interpretation of surface topography shown on maps, DEMs or stereo air photography.

Revisits to Evaluate Year-to-Year Differences: Many (111) of the flow transition points evaluated in 1998 and 2000 were revisited during the 2001 pilot surveys. The resulting 2001 data was inspected to determine whether the previously-identified flow transition point was in a similar or different location. The field criteria from the initial visit were recreated as closely as possible in 2001, so that apparent differences would indicate year-to-year changes in flow conditions rather than differences in field methods.

Summary of Results and Discussion

Basin Areas: The pre-2001 studies included nearly 300 streams statewide (Table 2). Reports generally focus on the distribution of basin areas for flow transition points, with the exception of the Kapowsin study (Liquori 2001). The range of basin areas was variable within and between individual study areas (Table 2). For instance, standard deviations were larger than means for most studies where reported. The range of means and medians for the various studies was considerably narrower, especially the medians. Given that the distributions of basin areas for each study area were strongly skewed, medians appear to be the better statistic to describe the central tendency. Large-basin outliers were found in each study area except for the Stillman basin (Table 2).

Table 2. Summary of basin areas for perennial flow transition points

Study Area	Term for flow transition point	Number of sites	Basin area statistics (acres)			
			Median	Mean	Min.-max	Standard deviation
Kapowsin	"Perennial initiation point[1]"	86	40	138	2 - 4207	472
	"Spatially intermittent initiation point"	34[2]	17	41	2 - 346	67
SW Washington	"Point of origin"	78	13	20	3 - 126	NR[3]
Mid-Columbia	"Point of origin"	32	32	90	1 - 624	NR[3]
Chelan	"Point of origin"	38	39	68	4 - 259	NR[3]
Stillman basin	"End of finger water"	10	10	11	8 - 15	2
Skagit	"Low flow initiation point"	43	17	23	1 - 136	256
1 – Perennial initiation points must be spatial continuous to downstream waters 2 – All spatially intermittent initiation points are located upstream of "perennial initiation points"						

Year-to-year variation: Locations of flow transition points differed between years at the majority (84%) of sites (Table 3). Among sites that differed from the initial visit, most (66%) were located upstream, though some were found downstream as well. The prevalence of transition points upstream presumably reflects greater summer precipitation in summer 2001 (despite the very dry winter) relative to the summer of the initial visit (Table 3). It has been hypothesized that the modest proportion (16%) of transition points found in similar locations in both years, reflects the local influence of springs or other stationary groundwater release points (Liquori 2001).

Table 3. Summary of year-to-year location of flow transition points

Study Area	Point	Years visited	Relative location of 2001 point (#):			Difference in summer precip.
			upstream	similar	downstream	
SW Wash.	PO	1998 & 2001	36	0	13	2001 wetter
Mid-Columbia	PO	1998 & 2001	9	3	3	2001 wetter
Chelan	PO	1998 & 2001	6	6	4	2001 wetter
Stillman	EOFW	2000 & 2001	3	4	1	2001 drier (for year)
Skagit	LFIP	2000 & 2001	12	5	6	2001 wetter
All areas	various	'98/'00 & '01	66 (60%)	18 (16%)	27 (24%)	Mostly wetter

References

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